California's Bioenergy Action Plan: The Role of Dairy Biogas

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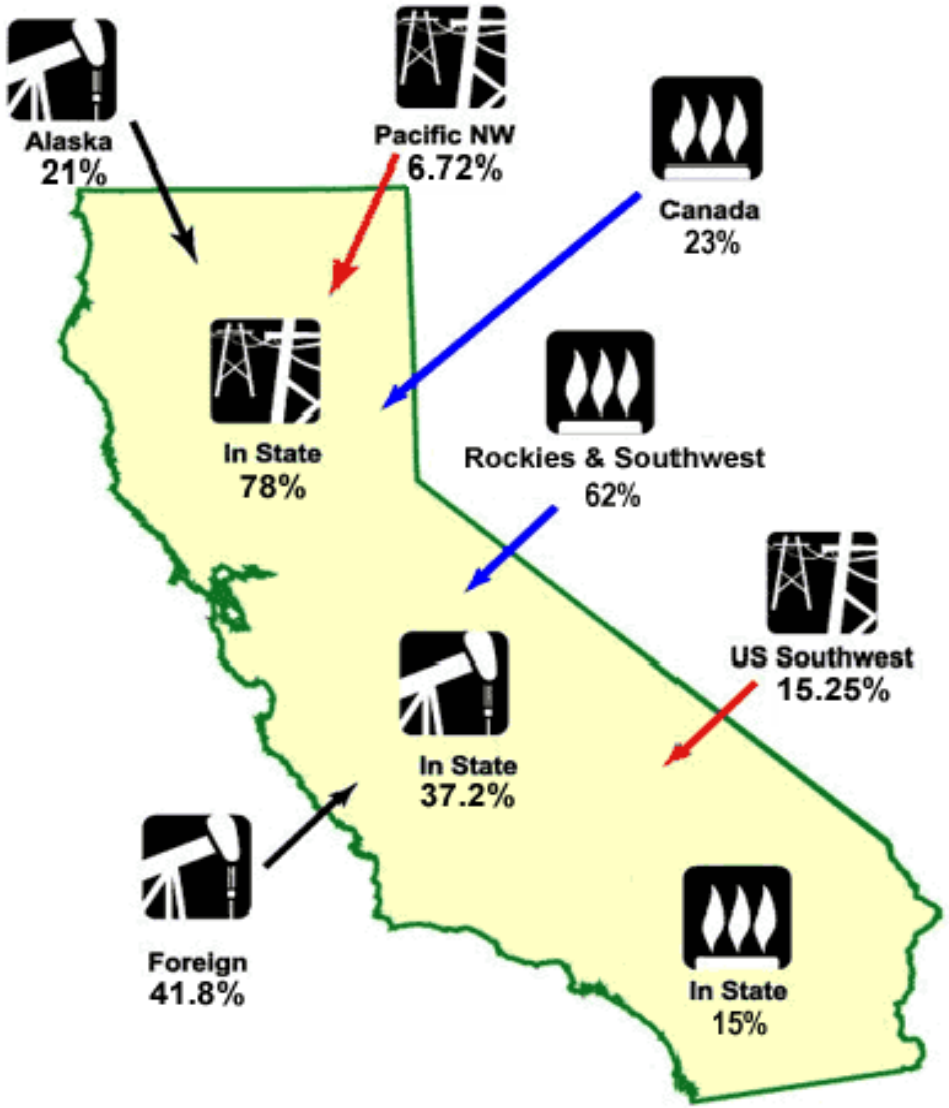
Presentation Outline

- California Context as a Nation State
- California's Renewable Portfolio Standard
- State Policies affecting Biofuels, Biogas and Biomass Power
- The Role of Biogas from Dairy Digesters in meeting Multiple State Policy Goals
- Lessons Learned and Outstanding Issues
- Summary and Conclusions

California as a Nation State

- The eighth largest economy in the world
- Population of 37 million Californians, 26 million motor vehicles and 1.7 million dairy cows
- Second largest emitter of greenhouse gases in the U. S., releasing 492 metric tons per year
- California leads the nation in having the lowest electricity use per person
- California has a diverse electricity resource mix, relying on renewable and convention resources

California's Energy Sources in 2005/2006



PETROLEUM (2005)

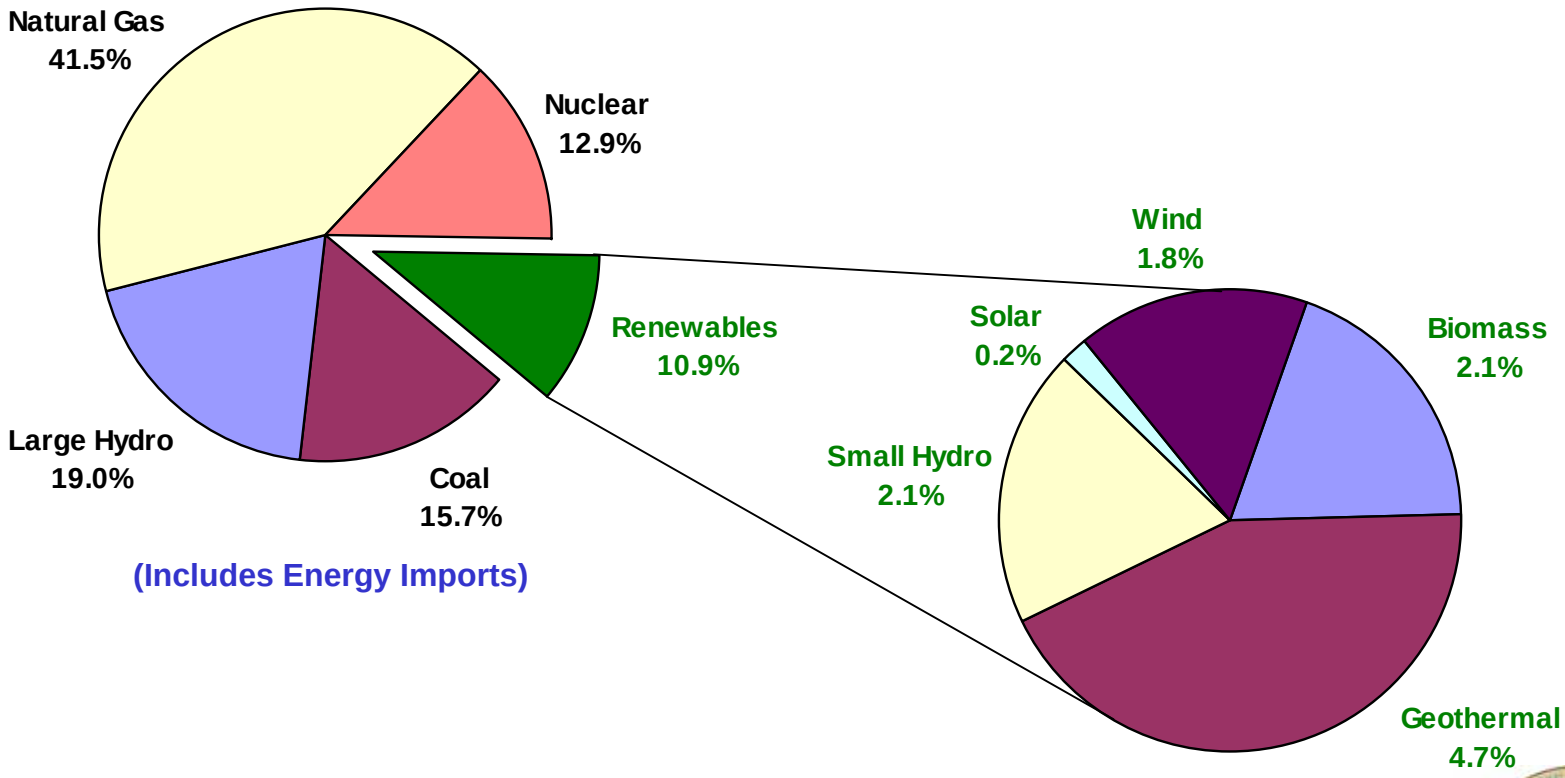
NATURAL GAS (2005)

ELECTRICITY (2006)

Source: www.energy.ca.gov/html/energysources.html
April 2007

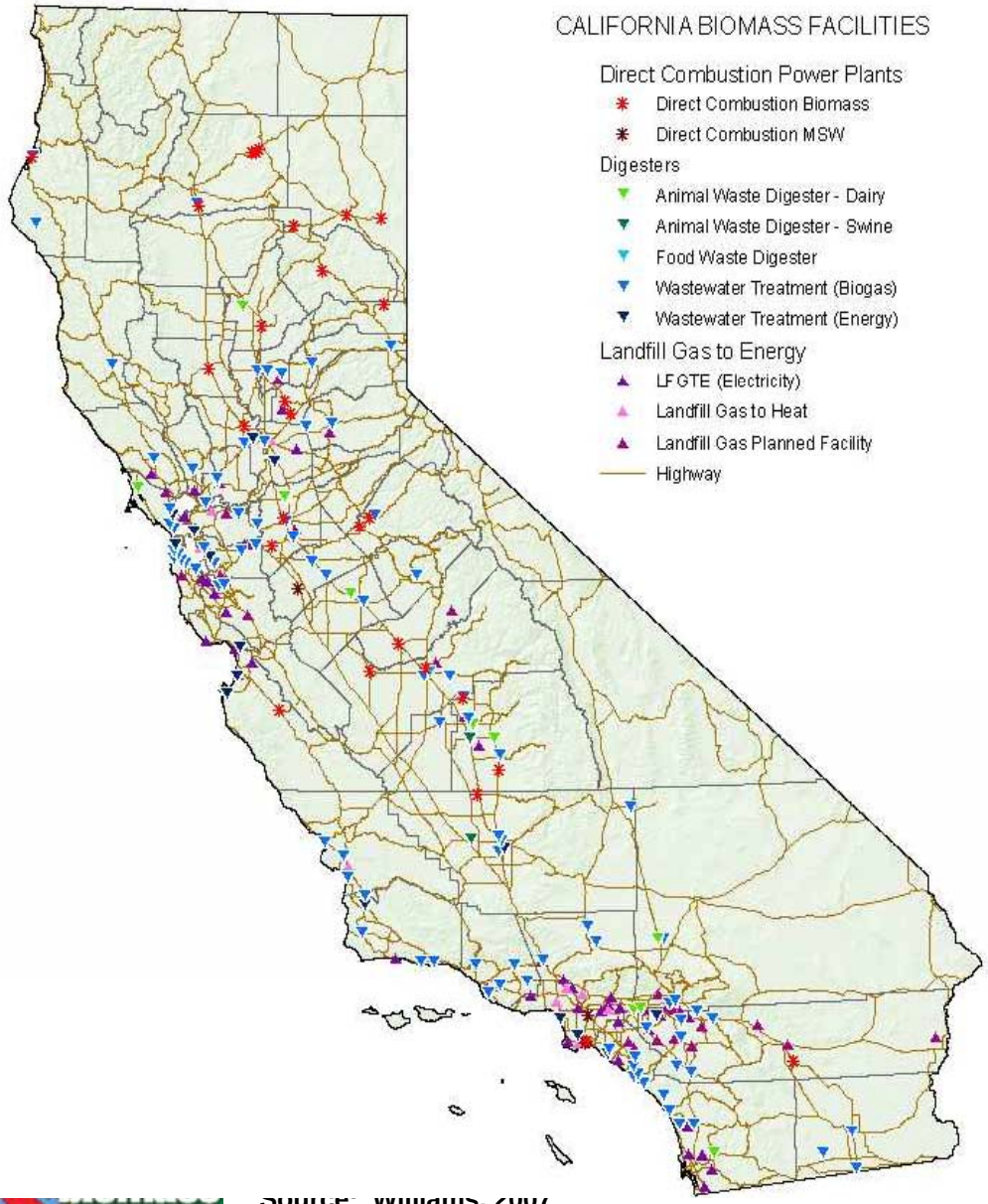
California's Electricity Supply in 2006

In-State Generation and Estimated Energy Imports by Fuel Type



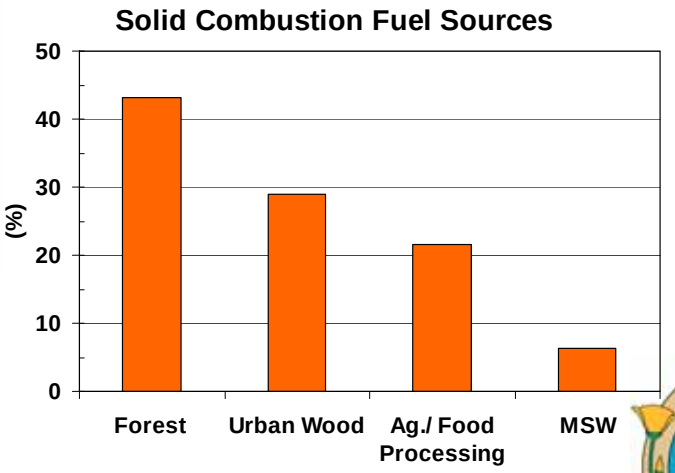
Source: *2006 Net System Power Report*, Energy Commission Publication, #CEC-300-2007-007.
www.energy.ca.gov/2007publications/CEC-300-2007-007/CEC-300-2007-007.PDF

Current Biomass Power Capacity in California



hnology/ l Source	Number of facilities	Gross Capacity (MW)
d Fuel Combustion ludes 3 MSW lities)	30	640
dfill gas-to-energy	60	275
tewater treatment *	20	64
mal and food waste ester	22	5.7
als	132	985

*** Suspect - Probably higher**



Source: Williams, 2007

State Renewable Portfolio Standard (RPS)

GOAL: Increase the diversity, reliability, public health and environmental benefits of California's energy mix.

- California's RPS law was signed in 2002, addressing our state's over-reliance on natural gas in electricity generation.
- Current legislative goal of 20% of retail sales from renewables by 2010, with increase by at least 1% per year.
- Governor Schwarzenegger's has expanded the goal to 33% by 2020.

RPS Eligible Technologies

- Biomass
- Biodiesel
- Conduit hydro
- Fuel cells using renewable fuel
- Digester gas
- Geothermal
- Landfill gas
- Municipal solid waste conversion
- Ocean wave, ocean thermal, tidal current
- Photovoltaic
- Small hydro
- Solar thermal electric
- Wind






Strategic Value of Bioenergy

The U.S. has large, diverse and untapped biomass resources which can support greater use in electric power, fuels and chemicals.
U.S. Potential = 1.3 billion tons
California = 80 million dry tons

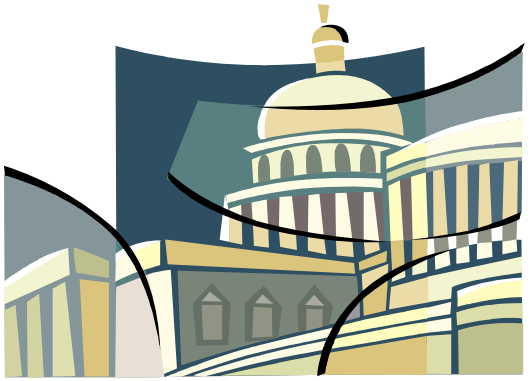
Biomass is an energy resource capable of achieving state petroleum reduction, climate change, renewable energy and environmental goals.

Use of biomass for energy production can address the U.S. and California's waste disposal and environmental problems, while creating local jobs.

Other public benefits include improving forest health and human and animal health, while avoiding catastrophic wildfires.

California State Policies Affecting Bioenergy

- **Governor Schwarzenegger signed Executive Order S-06-06 in April 2006 on Biomass, directing state agencies to promote instate biofuels production and use.**
- **At the Governor's direction, the Bioenergy Working Group released its Bioenergy Action Plan for California in July 2006.**
- **The California Legislation directed the Energy Commission to prepare a State Alternative Fuels Plan by 2007.**
- **The signing of Assembly Bill 32 (the Global Warming Solutions Act) and California's Low Carbon Fuel Standard will stimulate biofuels production.**

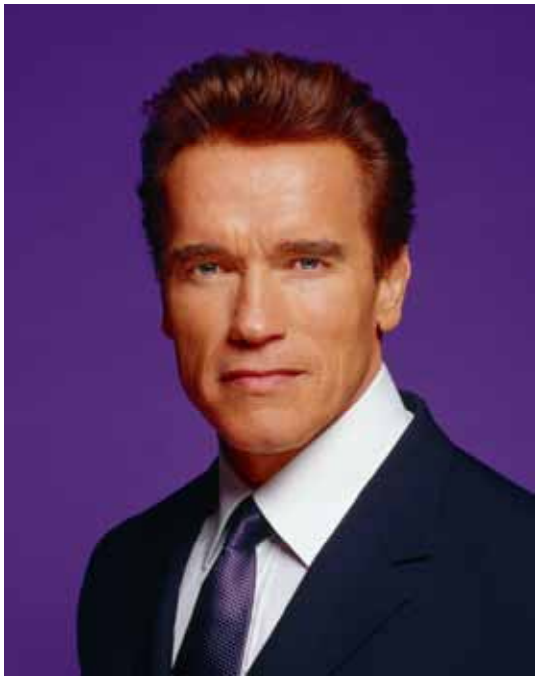


Governor Directs State Agencies to Expand Biofuels to Fight High Gasoline Prices

"It is critical that we do everything we can to reduce our dependence on petroleum based fuels. "

"Turning waste products into energy is good for the economy, local job creation and our environment."

---Governor Schwarzenegger
Sacramento, California
April 25, 2006



Governor's Executive Order S-06-06 on Biomass

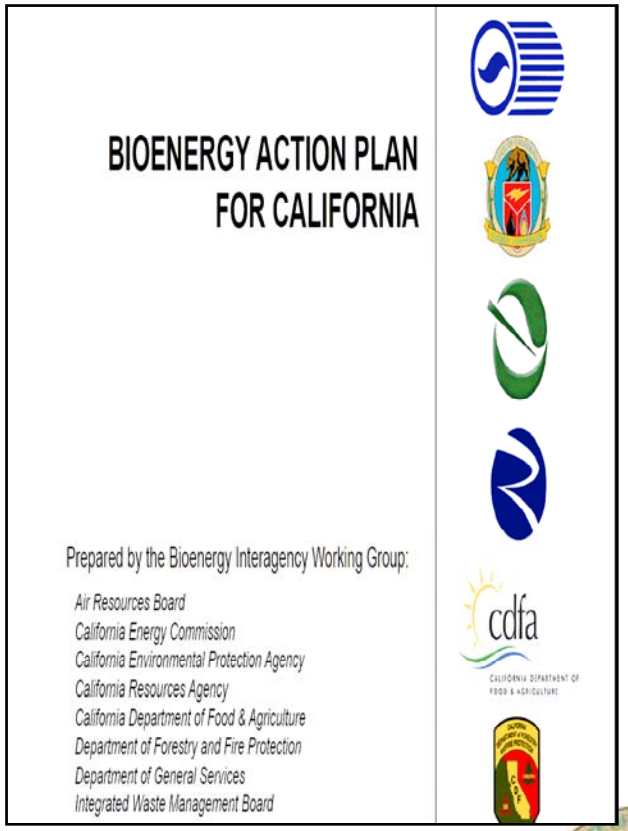
Established targets to increase in-state production and use of bioenergy, including ethanol and bio-diesel fuels made from renewable resources:

- **For biofuels**, the state shall produce a minimum of 20 percent of its biofuels within California by 2010, 40 percent by 2020, and 75 percent by 2050.

- **For biomass for electricity**, the state meet a 20 percent target within the established state goals for renewable generation for 2010 and 2020.

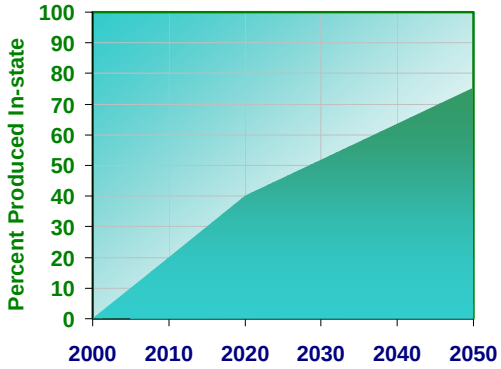
Bioenergy Action Plan

- **Coordinate research, development, demonstration, and commercialization efforts across federal and state agencies.**
- **Align existing state regulatory requirements to encourage production and use of California's biomass resources.**
- **Facilitate California as a market leader in technology innovation, sustainable biomass development, and market development for bio-based products.**
- **Encourage market entry for new applications of bioenergy, including electricity, biogas, and biofuels.**
- **Maximize the contributions of bioenergy toward achieving multiple state policy goals of petroleum reduction, climate change, renewable energy, and environmental protection.**
- **Address regulatory uncertainty and valuation of public benefits.**



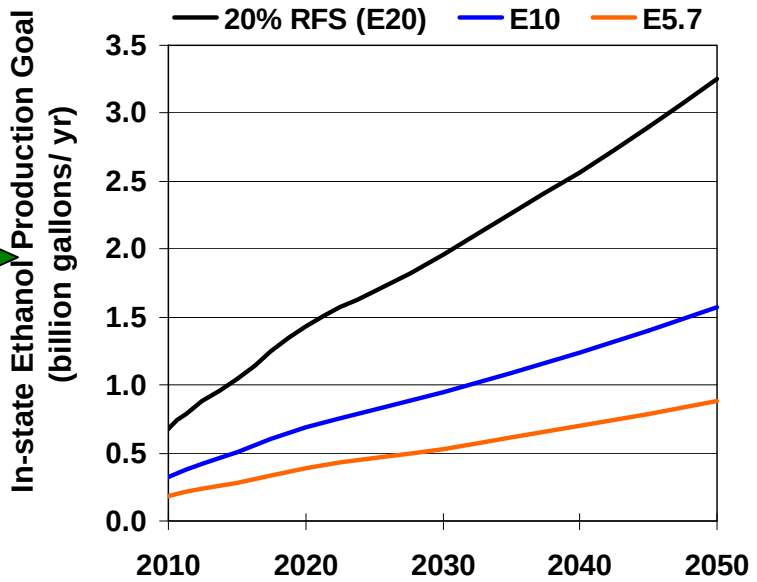
In-state biofuel production goals for blend rate scenarios

- Assuming projected transportation fuel growth rates and
- Executive Order S-06-06 goals for in-state biofuel production
  - 20% by 2010
  - 40% by 2020
  - 75% by 2050

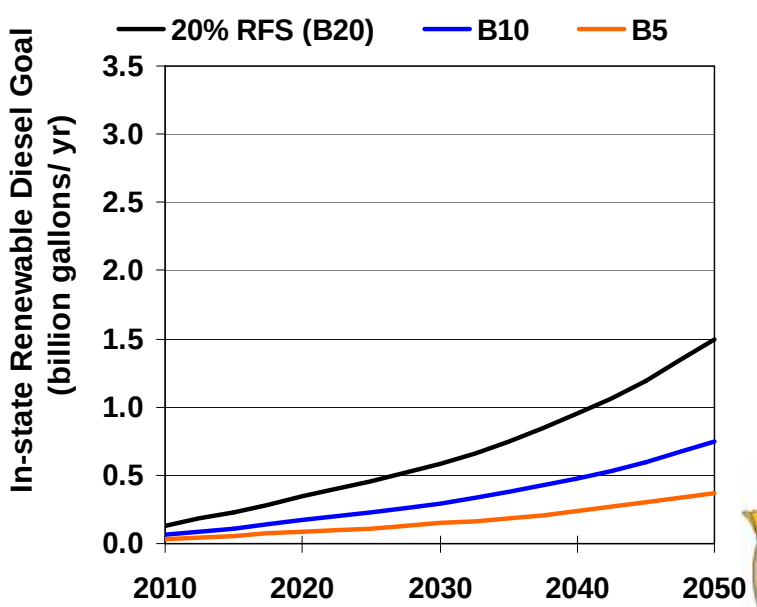


Source: Williams, 2007

Ethanol



Renewable Diesel



California Biomass Roadmap

Vision: Sustainable biomass resources energize a healthy and prosperous California through the environmentally beneficial production and use of renewable energy, biofuels, and bio-based products.

Priority Areas

- Resource access and feedstock markets and supply
- Market expansion, access, and technology deployment
- Research, development, and demonstration
- Education, training, and outreach
- Policy, regulations, and statutes

RD&D

- Resource Base, Sustainability and Access
- Bioscience/Biotechnology
- Biomass Conversion
- Feedstock Processing
- Systems Analysis
- Knowledge/Information Resources

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CALIFORNIA biomass

STATE OF CALIFORNIA ENERGY COMMISSION

State Alternative Fuels Plan

The Governor signed Assembly Bill 1007 (Chapter 371, Statutes of 2005) in September 2005, requiring the Energy Commission to:

- Develop and adopt a State Plan to Increase the Use of Alternative Fuels.
- Plan recommends goals, regulations, incentives and policies to increase use of alternative fuels.
- Work in partnership with the Air Resources Board and affected state agencies to carry out the Plan.
- The Energy Commission has a proceeding underway to complete the Plan.
- Plan was adopted by the Commission on October 31, 2007 and approved by the ARB on November 15, 2007.

AB 1007 Full Fuel Cycle Analysis

- A June 27, 2007, Well-to-Wheels study by the Energy Commission concludes that biofuels can provide large GHG reductions (up to 75 percent compared with gasoline).
- California prefers use of biomass-based fuels (agricultural, forestry and urban wastes), recognizing their petroleum reduction and GHG benefits. Benefits vary by feedstock.
- Better measurement of the agricultural land conversion effects, water and fertilizer use, food versus fuel competition, and sustainability impacts will be required.

California's Climate Change Initiative

"The debate is over. We know the science. We see the threat. And we know the time for action is now." ***June 1, 2005***

Global Warming Solutions Act of 2006

On September 27, 2006, the Governor signed Assembly Bill 32, the Global Warming Solutions Act of 2006.

California's initiative to limit greenhouse gas emissions will favor low-carbon technologies, including the increased use of renewable energy sources and alternative transportation fuels.

This landmark legislation, gives the California Air Resources Board (CARB) new responsibilities to:

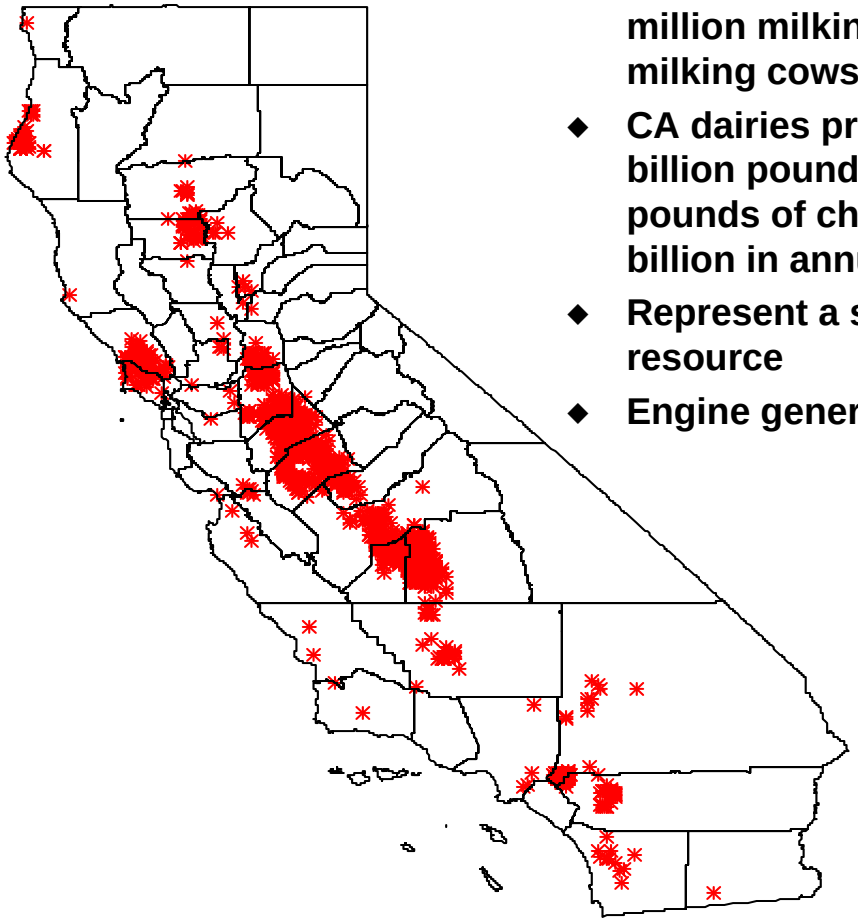
- Adopt a statewide greenhouse gas (GHG) emissions limit;
- Adopt regulations to achieve "maximum feasible and cost-effective GHG reductions;
- Adopt market mechanisms, such as cap-and-trade programs;
- Establish mandatory reporting of GHG emissions by large emitting sectors and industries.

California's Low Carbon Fuel Standard

On January 9, 2007, the Governor issued his Executive Order S-1-07, establishing the world's first Low Carbon Fuel Standard for transportation fuels.

- Under this proposal, petroleum refiners, gasoline seller and fuel suppliers must reduce the carbon content of their fuels by 10 percent by 2020.
- By regulating carbon fuel content, this standard will support the state's greenhouse gas reduction targets, while promoting the use of alternative fuels.
- Adding ethanol or other biofuels into gasoline is one option for meeting the Standard; advanced biofuels show promise.
- CARB adopted this Standard as an "early action measure" as required by Assembly Bill 32, and expects to complete its rulemaking in late 2008.

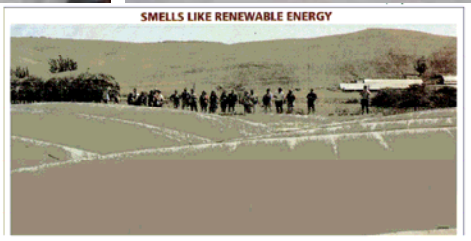
Distribution of Dairies in California



- California is home to about 1.7 million milking cows – 18% of U.S. milking cows
- CA dairies produce more than 27 billion pounds of milk, 1.25 billion pounds of cheese and generate $3 billion in annual sales
- Represent a significant bioenergy resource
- Engine generators at 10 CA dairies

Dairy Power Production Program

Biogas Digesters Installed at 11 Dairies in California & more to come



St Anthony Farm

- **11 systems funded ~ generating 3.3 MW total**
- **6 covered lagoons and 5 plug flow digesters**
- **7 new and 4 refurbished digester systems**
- **Lactating cows range from 245 to 7,931**
- **Dairy manure or mixture of dairy manure with cheese wastewater, creamery wastewater, and food processing wastewater**

Lessons Learned from Existing Dairy Digesters

- Regulatory issues, such as air and water quality permitting, need to be clarified and addressed.
- Net metering and utility interconnection issues and costs affect project economics.
- Technical and financing issues affect the economics of specific dairy digester projects.
  - Digester gas cleaning
  - Covered lagoons versus plug flow digesters
  - Heat pumps to enhance overall energy efficiency
  - Grants and incentives may be needed.

Outstanding Issues

- Better understanding of the technical, economic, and environmental performance of dairy digester projects
- Regulatory certainty and better permit coordination
- Role of technology advancement and overall energy efficiency
- Net metering and utility interconnect requirements

Summary and Conclusions

State policy initiatives, such as the Bioenergy Action Plan, the Global Warming Solutions Act, and California's Renewable Fuel Standard, support the production of biogas from California's dairies.

Biogas produced from California's dairies has the potential to address multiple policy objectives; methane recovery from dairies supports state climate change goals.

Many digesters are not cost-effective investments for farmers. incentives are needed to make them economically viable.

Other key issues include regulatory uncertainty and the need to incorporate the value public benefits from digester gas in the sale of electricity.

Energy Commission Research Studies

1. Ten Dairy Power Production Program 90-day Evaluation reports (Western United Resource Development)
2. Anaerobic Digester Implementation Issues (Resource Strategies Inc.)
3. Evaluation of Policy Impacts On the Economic Viability of California-Based Combined Heat and Power From a Project Owner's Perspective (Competitive Energy Insight Inc.)
4. Dairy Methane Digester System Program Evaluation report (WURD, available soon)
5. Resource Potential and Barriers Facing the Development of Anaerobic Digestion of Animal Waste in California (Mark A. Moser, 1997)
6. Economics of Dairy Digester Projects (Princeton Energy Research Institute under development)

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